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Abstract

International carbon markets, especially baseline and credit systems, are an important component of international climate policy, and enshrined in Article 6 of the Paris Agreement. We analyse the effects of the COVID-19 pandemic and its corresponding containment, emergency response and recovery policies on key economic sectors in developing countries. Building on these insights, we assess the impacts of COVID-19 and corresponding policies on crediting policies, considering baseline setting and stringency of nationally determined contributions (NDCs) of developing countries. Developing countries are of special interest for this research because, on the one side, the Paris Agreement architecture stresses the strengthened role of developing countries, which have to submit and achieve NDCs. On the other side, they are faced with sustainable development concerns and hence, might prioritise certain sustainable development goals (SDGs) (e.g. no poverty, zero hunger) over climate action against the background of the impacts of the COVID-19 pandemic. Depending on the recovery policies undertaken, sectoral priorities for sale of credits through Article 6 are likely to shift, and credit buyers, such as the Swiss KLiK Foundation, need to adjust their approaches accordingly.

Acknowledgment

The present discussion paper builds on and expands the original work: Baruah, Pranab; Mraz, Marian; Aouane, Fenella; of GGGI and Michaelowa, Axel; Poralla, Matthias; Kessler, Juliana; Butzengeiger-Geyer, Sonja; Brescia, Dario; of Perspectives (2020): Designing Policy Approaches under Article 6 Effects of the COVID-19 Pandemic on the Climate Policy Landscape in Selected Countries, GGGI paper forthcoming (<https://gggi.org/reports/>). GGGI funding for the original work is gratefully acknowledged.

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Acronyms

ADB	Asian Development Bank
BAU	Business-as-usual
CORSIA	Carbon Offsetting and Reduction Scheme in International Aviation
CO ₂	Carbon dioxide
ETS	Emissions trading system
EY	Ernst & Young
GDP	Gross domestic product
GHG	Greenhouse gas
GNI	Gross national income
ICAO	International Civil Aviation Organisation
IEA	International Energy Agency
IMF	International Monetary Fund
KP	Kyoto Protocol
NDC	Nationally determined contribution
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable development goal
SME	Small and medium-sized enterprise
USD	US Dollar
VAT	Value-added tax
WHO	World Health Organisation
WTO	World Trade Organisation

1. Introduction

While for decades, experts have warned against the risk of new pathogens that could trigger a worldwide pandemic, the emergence of a novel coronavirus that spreads through human contact hit the world unprepared in late 2019. Officially christened “COVID-19”, this coronavirus initially raged in China before spreading around the world. Since February 2020, the COVID-19 pandemic has become the biggest public health crisis the world has faced since the 1918 influenza pandemic. By November 2020 it has resulted in over 1 million deaths and over 50 million infected people worldwide (Our World in Data 2020). While accumulating medical experience has managed to reduce death rates, the disease continues to severely hit elderly people and people with co-morbidities. After an initial wave in spring, a second wave has erupted in autumn; countries hit by the two waves differ markedly. While medical research is pushing ahead at full steam to develop a vaccine and first promising results have been published, universal availability of an effective vaccine will at best be reached in 2021.

Going beyond a pure health crisis, the COVID-19 pandemic has now become an economic and socio-political crisis with severe impacts on the economy in every country worldwide. Given the high death rates, countries have been scrambling to contain transmission of the virus through restrictions of public and private lives never seen in peacetime in modern societies. These measures, including the lockdown of people in their homes and the closure of many production plants led to a significant decrease in greenhouse gas (GHG) emissions from April 2020 (Forster et al. 2020), reaching 9% at its maximum, the largest short-term emission reduction since the emergence of fossil fuels (see Liu et al. 2020).

As shown by the example of China, where the suppression of the epidemic and the subsequent reopening of the economy has led to emissions reaching the pre-COVID-19 level, the design of recovery measures “remains crucial in shaping the long-term pathways for emissions and determining whether the Paris Agreement’s 1.5°C temperature limit can be achieved” (Climate Action Tracker 2020). In other words, the COVID-19 pandemic could either accelerate or retard climate change action, depending on what measures governments take (Hepburn et al. 2020).

In a response to the crisis, governments around the world have followed a typical disaster risk management cycle with three distinct phases: First, they introduced **containment measures** already mentioned, such as full lockdowns of people at home, closures of schools and shops, international travel bans and social distancing, including remote work. This helped to contain the spread of the virus but led to severe disruptions of global supply and demand of workforce and goods. Second, to cushion these negative effects of the containment measures, governments announced **emergency response measures** that support the healthcare system and further economic sectors through fiscal policies (income support, tax relief and capital injections for vulnerable households and severely affected businesses) and monetary policy (policy interest rate changes, government bond purchases). Third, some countries have moved one step further by designing **recovery measures** and incentives for rebuilding the economy to overcome the negative effects of the pandemic and the containment measures. Most governments to date have implemented containment and emergency response measures, while recovery policies are mostly concentrated in G20 or industrialised countries.

Against this background, the paper is built around two research foci. First, we analyse the effects of the COVID-19 pandemic and its corresponding containment, emergency response and recovery policies on key economic sectors in developing countries. Developing countries are those countries whose gross national income (GNI) per capita falls in the low income and middle-income range. The World Bank (2020b) defines low-income economies as those with a GNI per capita of US Dollar (USD)

1035 or less in 2019, while the GNI per capita ranges between USD 1036 and USD 4045 for upper middle-income economies and between USD 4046 and USD 12,535 for upper middle-income economies.

Building on these insights, we assess the impacts of the COVID-19 pandemic and corresponding policies on those policies, that aim to generate carbon credits under Article 6 of the Paris Agreement. The new international market mechanisms under Article 6.2 and 6.4 aim to upscale crediting beyond specific mitigation projects and programmes to provide a significant contribution to climate action of these mechanisms (see Michaelowa et al. 2019). We focus on two issues: First, we analyse the impacts of COVID-19 related emissions changes on baseline setting, i.e. the process of defining a scenario that reasonably reflects the development of GHG emissions over time that would most likely have occurred in the absence of a given mitigation measure (Castro et al. 2012). Second, we discuss what this means for the stringency of developing countries' national climate mitigation and adaptation strategies as defined in their Nationally Determined Contributions (NDCs). The analysis also includes an assessment of the introduction of climate friendly recovery policies that could directly be used in the context of Article 6.

Considering the prominent Fridays for Future protests, demanding more ambition and concrete actions from decision-makers to prevent dangerous climate change, many countries will be urged to present net-zero strategies. Reaching these net-zero goals requires increased domestic mitigation efforts and/or international cooperation via market mechanisms, hence efficient policy crediting is essential. We specifically focus on implications of the COVID-19 recovery for developing countries' climate ambition and willingness to pursue market mechanisms. Developing countries are of special interest for this research because the Paris Agreement architecture stresses their strengthened role where they now take up mitigation targets under their NDCs. On the other side, these countries are faced with sustainable development concerns and hence might prioritise certain sustainable development goals (SDGs) (e.g. no poverty, zero hunger) over climate action against the background of the impacts of the COVID-19 pandemic.

Given the complex and rapidly changing nature of the COVID-19 pandemic and the corresponding policy measures, we gathered data in two ways: First, we used available third-party databases by e.g. the International Monetary Fund (IMF) (2020a), University of Oxford (Hale et al. 2020), Ernst & Young (EY) (2020), the Organisation for Economic Co-operation and Development (OECD) (2020), KPMG (2020) and Energy Policy Tracker (2020). Second, we gathered information from the internet and webinars.

Section 2 of the paper gives a general overview of the implications of COVID-19 and corresponding policies' impacts on different economic sectors and mitigation trends in developing countries. Section 3 focuses on the impacts of the COVID-19 pandemic on baseline setting and NDC stringency in developing countries. Section 4 focuses on direct climate friendly recovery policies and consequences for the consideration of carbon crediting policies. Section 5 summarises the key findings and provides an outlook.

2. COVID-19 and corresponding policies' impacts on key economic sectors and GHG emission trends

Since the first reports of COVID-19 surfaced at the end of 2019, the virus has spread across the world. By the end of January 2020, the World Health Organisation (WHO) declared COVID-19 as a public health concern and only two months later in March 2020 the WHO issued a formal warning of a pandemic. While most countries introduced a broad set of policies and measures that follow the typical disaster risk management cycle explained below (Fakhruddin et al. 2020), the speed of action and degree of enforcement of policies have differed widely, leading to significant differences in outcomes. While some countries, particularly in Oceania, East Asia and South East Asia have been able to virtually eliminate the virus, some regions that managed the first wave relatively well have been fully struck by the second wave.

2.1. Containment measures¹

In line with the disaster risk management cycle, governments applied containment measures as a first response to reduce spreading of the virus. Containment measures aim to reduce the number and intensity of human contacts. Measures start with quarantining of suspected cases, distancing requirements (e.g. not exchanging physical greetings, 1.5 metre distances for gatherings) and, in increasing order of severity, included mandatory mask wearing, limiting the number of participants in public events, remote work, closing of cultural and sports venues, restaurants, shops, and schools, to a full lockdown where people are not allowed to leave their home except for absolute necessities. Domestic measures were generally complemented with restrictions of international travel, ranging from quarantine requirements to travel bans and border closures. Confronted with the rapid spread of the virus around the world, in March and April 2020, with few exceptions, governments introduced lockdowns and closed borders which led to severe disruptions of global supply and demand for goods and services on the other side. Roughly 80% of global workforce was hit by the measures and the resulting standstill of businesses led to a substantial reduction of energy demand (Hepburn et al. 2020). In the second wave, governments tried to keep economic activity running and thus resorted to lockdowns only when the rate of new infections was much higher than in the first wave. Below, we look at the impacts in four key economic sectors: (i) energy (including electricity generation), (ii) industry (iii) tourism (including aviation) and (iv) transport (excluding aviation).

2.1.1. Energy (including electricity generation)

Due to the global standstill in the first COVID-19 wave, energy demand crashed. The sudden, severe restriction in transportation during lockdowns had an economically unprecedented impact on the oil price, which temporarily reached negative values in April 2020. Coal and gas prices fell significantly as electricity demand from industry and offices plunged. Renewable electricity production proved highly resilient to the crisis given that operating costs of renewables are lower than those of fossil power plants. The International Energy Agency (IEA) (2020a, 2020b) projects that demand for fossil fuels in 2020 will be between 5% and 9% lower than in 2019 while renewable electricity generation would

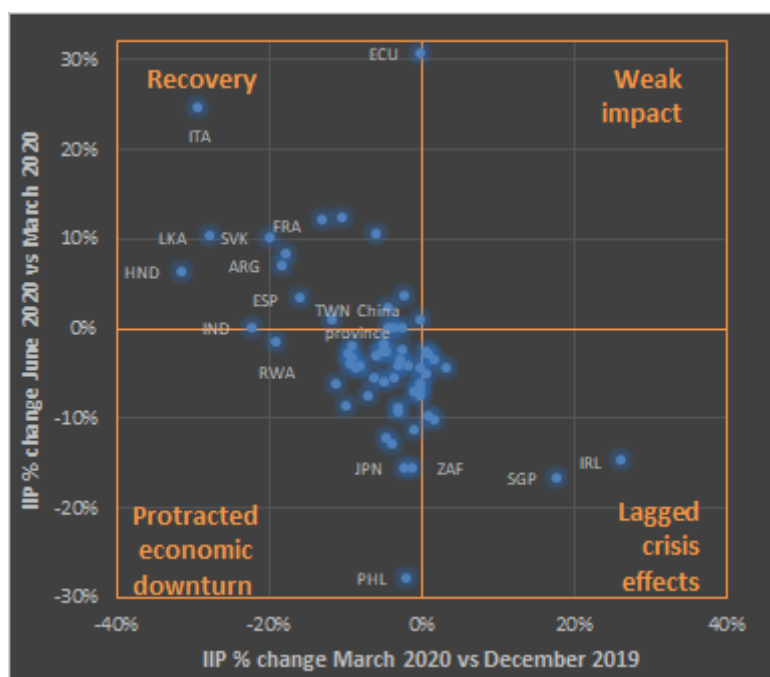
¹ This chapter largely builds on chapter 2 from Baruah et al. (2020).

grow by around 5%. These estimates were made before the second wave and thus are likely to be too low.

2.1.2. Industry

Industrial production has been hit directly and indirectly by the containment measures. Lockdowns led to temporary factory closures. The tight web of supply chains was broken by such closures as well as the disruptions of international transport. The indirect impact through the decrease of demand for industrial products was more lasting, and structurally challenging. The closure of shops meant that consumers could procure goods only through virtual means. Partial or full lockdowns meant that labour demand fell drastically, as only few sectors of the economy continued to function normally. Unemployment rates soared in many countries. Actual or feared job losses meant that households reduced their spending, sharpening the demand decrease. According to UNIDO (2020b), industrial production worldwide fell by 5.6% between December 2019 and March 2020 and another 2.5% until June 2020. Overall, the World Trade Organisation (WTO) expects a 13%-32% decline in the world merchandise trade in 2020 (WTO 2020).

Figure 1: Changes in industrial production in the first and second quarters of 2020



Source: UNIDO (2020b)

2.1.3. Tourism (including aviation)

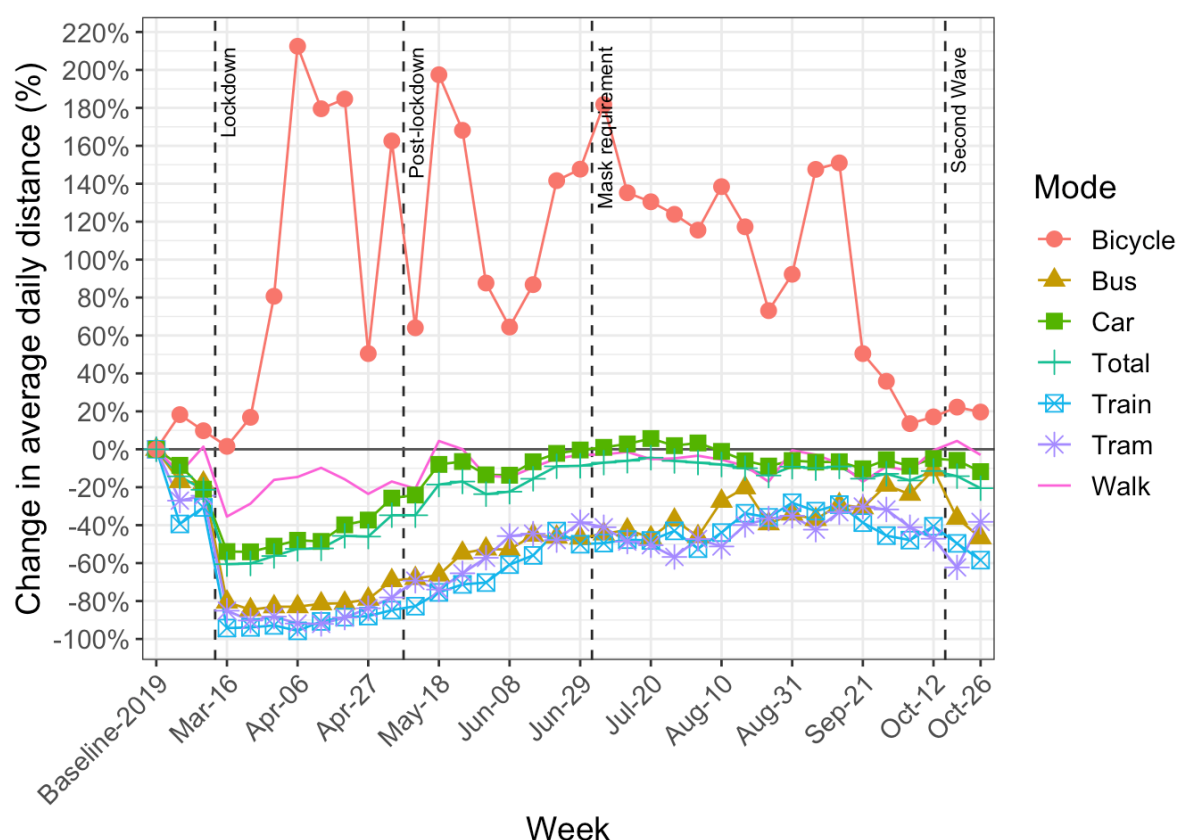
The tourism sector which had constantly grown over the past years, was hit particularly hard. Over 70% of global destinations closed their borders to international tourists for a certain period of time (UNWTO 2020). Travel restrictions continue to develop haphazardly and in a sudden manner, the travel update report (Newland Chase 2020) now has over 220 pages. Until the end of August, international tourism declined by 70% compared to 2019 (UNWTO 2020). According to the International Civil Aviation Organisation (ICAO) (2020) until the end of October, the number of flights fell by 37% in 2020

compared to 2019, with the maximum decline of 72% recorded in May. The number of seats sold contracted even more drastically, by 49% in total and 82% in May.

2.1.4. Transport (excluding aviation)

Several social distancing measures reduced transport demand in all its forms. However, after the first shock, a differentiated impact on transport can be seen. Due to the continued perception of infection risk in public transport, the share of private modes of transport have increased. While data are surprisingly scarce, ETH Zurich and University of Basel (2020) give a clear indication of the trends in Switzerland that may be typical for industrialised countries. The shift from public to private transport modes will result in higher sector greenhouse gas emissions given that the non-motorised private modes only cover a small share of total kilometres travelled.

Figure 2: Transport modal split in Switzerland during the pandemic



Source: ETH Zurich, University of Basel (2020)

2.1.5. Overall impacts of the pandemic on economies and emissions

The impacts of the pandemic on the global economy and greenhouse gas emissions can be summarised as follows: The IMF projects that the overall global economy will shrink by almost 5% (compared to the previous year) (IMF 2020b), while the World Bank predicts a 5.2% contraction of the global gross domestic product (GDP) for 2020 (World Bank 2020a). For emerging markets and developing

economies the World Bank forecasts a 2.5% reduction of GDP and for low-income countries a stark slowdown of GDP growth to just 1% (World Bank 2020a).

At the beginning of April 2020, daily carbon dioxide (CO₂) emissions fell by 18% (compared to 2019), but have already risen again by 13% in June 2020 (Le Quéré et al. 2020a, 2020b). For the whole year of 2020, the IEA expects an 8% drop of global CO₂ emissions (IEA 2020c).

2.2. Emergency response measures²

To cushion the negative effects of the containment measures in the short- to medium-term, governments have implemented emergency response measures. These policies can be broadly differentiated into four groups of fiscal and monetary measures and one group of political-institutional approaches (IMF 2020a; Hale et al. 2020; EY 2020; OECD 2020; KPMG 2020; Energy Policy Tracker 2020):

First, **healthcare support** measures include purchasing of medical equipment and face masks, the development of test kits or the upgrade of medical and laboratory facilities. Second, **income support and social protection** measures for vulnerable households who have been impacted by the pandemic and the containment. These measures include e.g. cash transfers, wage support, tax relief, food aid or reduction of utility payments. Third, **financial support** programmes for severely hit businesses and industries via tax changes and capital injections, often focusing on small and medium-sized enterprises (SMEs) in the service sector. For example, governments have issued value-added tax (VAT) exemptions and postponements, corporate income tax reliefs, new credit lines or the postponement of social security contributions. Fourth and lastly, governments, in collaboration with central banks, have **lowered interest rates**, purchased government bonds and provided liquidity for banks and the finance sector (Stiglitz 2020). Institutional responses to the crisis range from appointments of dedicated focal points and spokespersons within existing ministries or agencies to the establishment of special committees and inter-ministerial working groups which are in charge of monitoring the situation and proposing adequate solutions (IMF 2020a).

Almost all developing countries have moved from the initial containment phase to the emergency response phase. While most of the introduced emergency measures are defined economy-wide and benefit more or less all affected households and companies, Table 1 lists some sector-specific examples of implemented emergency response measures by developing countries across the world:

² This chapter largely builds on chapter 3.1 from Baruah et al. (2020).

Table 1: Sector-specific examples of implemented emergency response measures

Sector	Emergency response measures
Healthcare³	<ul style="list-style-type: none"> Budgetary support and lowered import duties and taxes for the purchase of medical equipment, development of test kits, upgrade of medical and laboratory facilities Income support and tax relief measures for medical staff
Energy (incl. electricity generation)	<ul style="list-style-type: none"> VAT and income tax exemptions for renewable energy companies Deferral of the deadline for VAT and corporate income taxes
Industry	<ul style="list-style-type: none"> Deferral of the deadline for VAT and corporate income taxes Postponement of social security contributions
Tourism (incl. aviation)	<ul style="list-style-type: none"> VAT exemptions for tourism service providers including hotels, bars, airlines, travel agencies and touristic sites Reduced VAT on aviation fuels and airline tickets Exemption from surcharges on electricity bills Reduction and suspension of rental fees and charges at airports and car rental agencies
Transport (excl. aviation)	<ul style="list-style-type: none"> Deferral of the deadline for VAT and corporate income taxes Temporary exemption from surcharges on electricity bills

Source: Authors based on IMF (2020a), Hale et al. (2020), EY (2020), OECD (2020), KPMG (2020) and Energy Policy Tracker (2020).

2.2.1. Characteristics of developing country emergency response measures

Despite the significant differences between developing countries' capacities, the amount of money (in percentages of GDP) provided for emergency response measures is similar. While the lower end is somewhere around 1% of GDP and the upper end is around 12% of GDP, most of the implemented emergency measures to date mobilise around 2%-6% of GDP (IMF 2020a). Looking more closely at the addressees of these emergency responses, it becomes clear that most emergency response policies address households and companies economy-wide. Only few emergency policies are more sector-specifically formulated and provide support for severely hit sectors like tourism or energy.

Most emergency policies implemented to date, aiming to keep companies afloat, do not have a climate policy component, i.e. they do not exclude emission intensive production processes.

³ Note that we did not include the healthcare sector in our main analysis but decided to include it in this section due to its central importance in the emergency response phase and the observation that all countries across the world have substantially scaled up their support for this sector.

2.3. Recovery measures⁴

The third step of dealing with the pandemic are recovery measures to durably overcome its negative effects and provide substantial political and financial incentives for the medium- to long-term (IFRC 2020; Fischedick and Schneidewind 2020; Sierra Club 2020). To date, comprehensive recovery packages have been almost exclusively introduced by G20 countries (ILO 2020), which includes large emerging economies. In contrast to the other policy fields, an intense discussion on making recovery climate friendly has erupted (Hepburn et al. 2020, Fischedick and Schneidewind 2020, Sierra Club 2020, Surabi 2020), and policymakers in a number of countries aim at such measures. In the energy sector, climate-friendly recovery measures in G20 countries include support schemes for renewable energy as well as new feed-in tariffs for solar and wind (see Box 1 below).

Box 1: Spotlight on recovery measures in the energy and electricity sector in Turkey

The Turkish government has spent around USD 3 billion (0.4% of GDP) to support different energy types since the beginning of the COVID-19 pandemic. Almost all this funding is committed to unconditional fossil fuels leaving only a small amount of money which is dedicated to minor unconditional clean energy projects. Concrete examples of the unconditional fossil fuel policies include i.e. specific discount rates up to 12.5% on the prices of gas sold to power plants, support payments leading to increasing employment and reducing the costs of production in the coal sector or introducing regulatory rollbacks on oil and gas production sites (Energy Policy Tracker 2020). In contrast, only two policies have been announced that can be classified as unconditional clean energy projects: First, a solar auction aiming to increase solar energy production by 1 Gigawatt and second, the introduction of a green tariff to encourage the use of domestic renewable energy (Energy Policy Tracker 2020).

Climate friendly recovery measures in the transport sector include tax benefits for airlines tied to emission reduction targets, expanding bike lanes, promoting the use of micro-mobility transportation (e.g. electric bicycles), increasing the quantity of public transportation lines, and revised depreciation regimes benefitting ground transportation vehicles (with higher depreciation rates for hybrid and electric vehicles). Campaigns supporting domestic tourism as well as revised depreciation regimes benefitting touristy construction sites can have mixed impacts. On the other hand, electricity subsidies, fuel price reductions can have a negative impact on national climate mitigation strategies. (IMF 2020a; Hale et al. 2020; EY 2020; OECD 2020; KPMG 2020; Energy Policy Tracker 2020).

Generally, recovery policies in developing countries are less well financially endowed than those of G20 countries, or remain largely in the planning status (ILO 2020). Despite these shortcomings, some developing countries have moved further and already announced recovery policies (Table 2 in the Appendix provides an overview).

We identified the following climate friendly recovery policies in developing countries:

⁴ This chapter largely builds on chapter 3.2 from Baruah et al. (2020).

The Colombian government has identified “clean and sustainable growth” as one of the pillars of its current recovery plan, described as the “new commitment to the future of Colombia”. This commitment is intended to develop projects in renewable energies, climate impact mitigation, biodiversity protection and hydrocarbon. It includes a total of 27 strategic renewable energy and transmission projects. The government expects these plans to “position Colombia as a regional leader in the energy transition”. The projects have an investment volume of USD 4.2 million and are expected to generate more than 55,000 jobs (Government of Colombia 2020). Other commitments include the implementation of the Dike Canal project which is intended to contribute to the decontamination of the Bay of Cartagena and to accelerate the navigability of the Magdalena River, thereby generating an increase in cargo transport. Another plan is to plant 180 million trees and provide incentives for silvopasture production and agroforestry schemes. Moreover, the Colombian government aims to eradicate the illegal exploitation of minerals, with a view to preserving strategic ecosystems and protecting water basins. The overall goal is to restructure the mining and hydrocarbon sector and move towards sustainable practices that provide real and permanent benefits to the communities (Government of Colombia 2020).

In Egypt, the ministries of industry and petroleum have agreed on a new lending initiative that aims to replace obsolete vehicles and convert cars to run with natural gas. The initiative is based on soft loans for citizens at zero-to-low interest rates. In doing so, the government aims to improve public transport, support the national industry, maximise the benefit from recent natural gas discoveries, and protect the environment. The Central Bank of Egypt and other banks have been asked to set conditions for payment conditions (Egypt Independent 2020).

Indonesia considers upscaling geothermal investments in its recovery programme given that the Asian Development Bank (ADB) has announced to double its loan commitments to support Indonesia’s recovery. The world’s largest known geothermal reserves can be found in Indonesia, but it has exploited less than 9% of its potential to date (Harsono 2020).

In its economy-wide Economic Sustainability Plan, the **Nigerian government** has announced a series of different recovery measures totalling around USD 6 billion (1.3% of GDP). Energy-related policies include a USD 230 million national program to promote the domestic use of compressed natural gas and a USD 60 million plan to convert the energy use of 30 million households and industrial sites from kerosene, charcoal and diesel, to liquefied petroleum gas (KPMG 2020). The government’s plan also features a renewable energy strategy to provide up to 25 million people with solar power through newly installed solar power systems and to further improve the solar power research and development capacities (Carbon Brief 2020).

2.3.1. Overview on recovery policies in developing countries

In accordance with the observation for the emergency response measures, the recovery measures implemented to date also address economy-wide concerns as well as provide specific recovery options for those sectors which have been hit hardest by the pandemic. Furthermore, and in line with the emergency response measures, most of the recovery policies provide unconditional support schemes independent of the specific business operations. This means that e.g. conventional farmers and fossil fuel producers are eligible to receive the same recovery support as organic farmers and renewable energy producers. Against this background, the effect on GHG emissions is ambivalent and depends on the exact design of the measure.

Despite these similarities, there are also some differences expressed in the recovery policies. On the one side, some developing countries have started to cut back environmental protection taxes for

various services or products (e.g. jet fuels) and hollowed out existing environmental standards (e.g. for the mining industry). These clearly are signs that run against emission reduction efforts or sustainable development goals. On the other side, some of the proposed recovery packages are in line with taking decisive climate action and refer to green recovery strategies overall. Individual green recovery policies for the energy and electricity sector range from expanding solar and wind capacities and supporting geothermal power, to developing ultra-high voltage electricity transmission, increasing the taxes on petrol and diesel and also switching from oil-fuelled to gas-fuelled generators. Green recovery policies addressing the transport sector encompass, among others, a wider rollout of charging stations for electric vehicles, special depreciation regimes that replace obsolete vehicles and benefit electric and hybrid vehicles, the expansion of solar and wind capacities, increasing cargo transport or switching from oil-fuelled generators to gas-fuelled. In the agriculture sector, climate related recovery measures seek to foster resiliency by increasing domestic productivity and providing incentives for silvopasture production as well as agroforestry schemes.

In none of the analysed recovery policies references were made regarding the role of Article 6 or international cooperation under existing or future carbon markets.

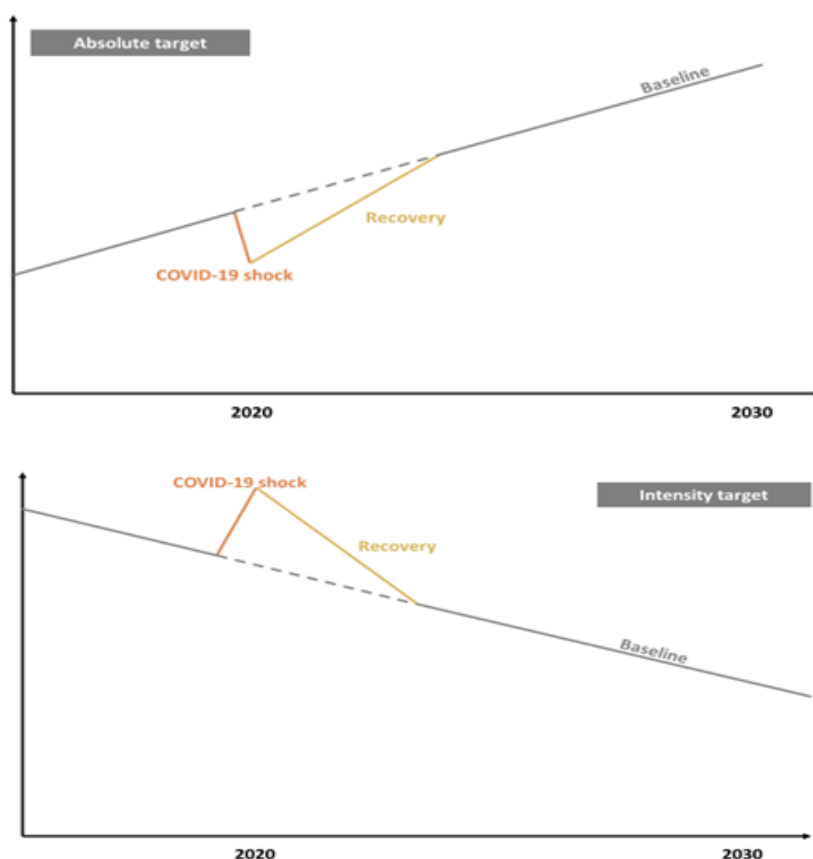
3. Impact of the COVID-19 pandemic on baseline setting for policy crediting⁵

Building on the analysis of announced and implemented containment, emergency response and recovery policies, this section analyses their impact on baseline setting, both at the national and sectoral level and reflects on the implications for policy crediting. Baseline setting is defined as a scenario that reasonably reflects the development of GHG emissions over time that would most likely have occurred in the absence of mitigation measures (Castro et al. 2012). At the national level, countries use country-level or sectoral Business-As-Usual (BAU) emission projections as baseline of their NDC targets. In the context of policy crediting, such national level baselines will be the starting point for calculation of mitigation outcomes (see Michaelowa et al. 2019).

NDC stringency will be affected by the emission impacts of the pandemic due to lower economic activity. The effects of the COVID-19 pandemic on the NDC stringency depend on the nature of the targets (see Figure 3). In case of an NDC with absolute targets (e.g. fixed-level targets in Mt CO₂e), the targets can most likely be easier reached because of lower emissions due to less economic activity. NDCs with intensity targets (e.g. tCO₂/GDP) compared to a historical base year will be more difficult to reach, as the 2008-2009 financial crisis showed that relative CO₂ emissions increased due to low utilisation rates in the industrial sector.

⁵ This chapter largely builds on chapter 4 from Baruah et al. (2020).

Figure 3: Effects of COVID-19 on absolute and relative emissions



Source: authors

All Parties to the Paris Agreement will have to take these effects into account when revising their NDCs. It remains to be seen how countries will approach the NDC revision and the accounting for COVID-19 effects on the baseline, as some countries have already submitted their revised NDCs, others will do so in the near future. Most countries are already delaying their NDC revisions as only 80 out of 197 revisions are expected to be submitted this year (Doyle 2020). These countries are now in the position that they can consider the COVID-19 effects during their revision process. There might also be countries that do not account for COVID-19 effects or even use an argumentation of force majeure.

Furthermore, COVID-19 will also influence baselines depending on whether they are static or dynamic. In the case of dynamic baselines, the formula for the calculation of BAU emissions projections is determined ex-ante, whereas the parameters included in the calculations are quantified ex-post (Michaelowa et al. 2019). While baseline scenarios are usually modified to reflect either technical updates or substantial changes to the definition of the baseline itself, dynamic baselines will automatically adapt to the shock and recovery effect and most likely be lowered.

3.1. Impacts on national baseline setting

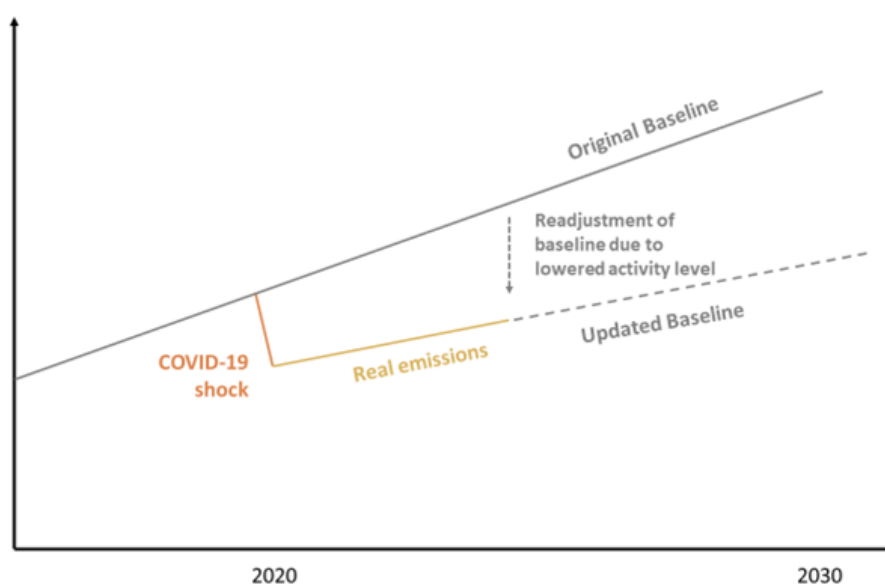
As the effect of COVID-19, in terms of lower economic activity, has an impact on GHG emissions, this extent and the duration of this effect depend on the country's recovery. Whereas some observers forecasted a quick recovery (V-shaped recovery) at the beginning of the crisis, it relatively quickly

became clear that it would take longer for countries to recover from the COVID-19 pandemic. Currently, it looks like the recovery takes a W-shaped form due to the second wave of the pandemic. During a recovery, emissions levels can increase quickly: After the financial and economic crisis in 2008 and 2009, GHG emissions rose by 5.1% in 2010 (Le Quéré et al. 2020a).

Since countries typically develop their baseline based on the assumption that the economy grows steadily and that total emissions increase over time, the sudden decrease of emissions is not accounted for by national BAU forecasts. This might result in a similar situation as under the Kyoto Protocol (KP) where huge surpluses of Assigned Amount Units were generated due to the replacement of socialism by market economies in the countries in transition. The KP market mechanism Joint Implementation was abused to ‘launder’ this surplus (Kollmuss et al. 2015). Therefore, it is pivotal that countries that are in the process of revising their NDCs take the effects of the COVID-19 pandemic into account and adjust their baselines and NDC commitments, respectively. However, high uncertainty regarding the duration and depth of future infection waves impedes the assessment of how future global CO₂ emissions will be affected.

In the development of an NDC, countries assume a steadily rising baseline. Consequently, the same risk as in the case of the EU emissions trading system (ETS) after the financial crisis emerges in the context of NDC development and policy crediting. In case these effects are not considered, the COVID-19 impacts could result in a surplus of saleable certificates under the new market mechanisms with undesirable long-term effects. Therefore, it is important that each NDC update takes into account the medium- to long-term emissions reduction effects of the COVID-19 pandemic and adjusts its baseline and climate contributions respectively as depicted in Figure 4.

Figure 4: Baseline adjustment in the context of NDC updates

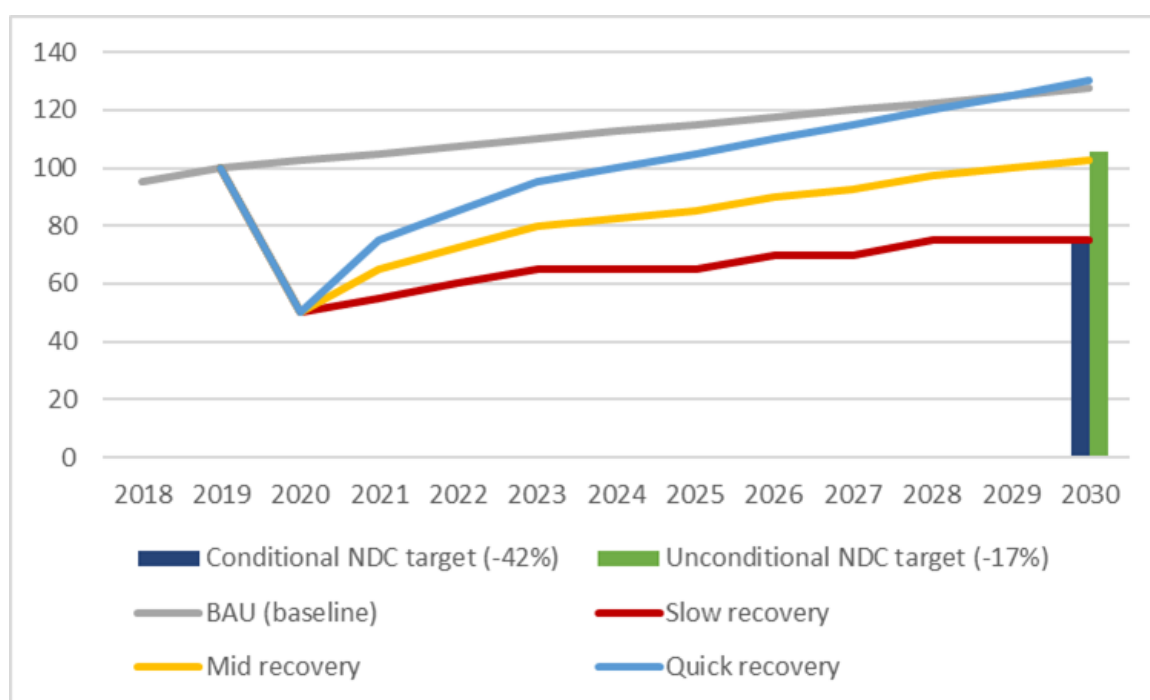


Source: authors

Figure 5 shows the impacts of COVID-19 on future emissions and NDC stringency under a hypothetical recovery scenario for the Moroccan tourism sector. It is assumed that Morocco's NDC of -17% (unconditional) and -42% (conditional) compared to BAU, is equally broken down to all economic sectors. In addition, the BAU emissions are assumed to increase by 2.5% per annum compared to 2019 — i.e. BAU emissions in 2030 are 127.5% in 2030. Hence, the unconditional NDC target of -17% would equal a target level of 106, the -42% conditional NDC a target of 74.

If the COVID-19 pandemic lasts longer, in line with the mid recovery and slow recovery scenario, the baseline scenario NDC targets are met more effortlessly due to the GHG emissions reductions. If the NDC targets are not adjusted, so-called “hot air” will be created in the context of Article 6 market mechanisms.

Figure 5: Potential impacts of the COVID-19 pandemic on emissions in the Moroccan tourism sector



Source: authors

3.2. Impacts on sectoral baseline setting

Key parameters that affect emissions, such as industrial production levels, fuel prices, economic development and autonomous technical progress, need to be considered when setting baselines. Given that these parameters are based on forecasts, they entail a high degree of uncertainty which makes the setting of baselines a challenging task. Next to the key parameters, changes to human

behaviour evoked by the COVID-19 pandemic have an impact on sectoral GHG emissions. In the following, we assess the impacts on four different sectors (energy, industry, tourism and transport) at a global level to provide an indication whether the baseline would need to decrease, stay the same or increase. This, in turn, will have an impact on the development of crediting baselines which we will further reflected upon in the next section.

3.2.1. Energy (including electricity generation)

It is estimated that the demand for oil might decrease by 8% or 2.6 GtCO₂ in 2020 (IEA 2020a). Demand for coal and natural gas is expected to drop by 8% and 4% in 2020 respectively (IEA 2020a) as gas becomes more competitive (Fulwood 2020). In addition to that, reduced transport demand will result in a decline of biofuel use of 15% in 2020 (IEA 2020c).

In the first half of 2020, global coal power generation declined by 8.3% (Jones et al. 2020). Renewable power has shown resilience to the COVID-19 situation so far. In the first quarter of 2020, renewables have contributed almost 28% to the global electricity supply (IEA 2020d), the share of wind and solar power has already increased from 8.1% to 9.8% in the first half of 2020 (Jones et al. 2020). However, the growth of installed wind, solar and battery capacity in 2020 will decrease and solar photovoltaic installations are expected to decline by 48% in the second quarter of 2020 (Hepburn et al. 2020). This is due to a decline in investments in renewables by up to 10%, due to global supply chain disruptions and delays of constructions plans and impeded mobilisation of funding (IEA 2020c). Similarly, renewable heat consumption is also projected to decline due to less activity in the industry sector and a lower cost competitiveness regarding the reduced costs of fossils fuels (IEA 2020d).

The reduced demand for oil, alternative fuels, coal and natural gas as a consequence of the COVID-19 pandemic, will require baselines to move lower, probably in the short- to medium-term. Regarding electricity, the COVID-19 pandemic has resulted in a decline of emission intensity in case of a significant share of renewables. This, in turn, implies reduced baseline emissions. In the long-term, problems regarding the financing of renewable electricity projects may increase baseline emissions, but such an effect is contingent on capital scarcity.

3.2.2. Industry

The COVID-19 pandemic has had a significant impact on the industrial activity at the global level. In April, daily global emissions in the industrial sector decreased by 4.3 MtCO₂ (19%) (Le Quéré et al. 2020a), mainly due to production stoppages and supply chain disruptions. The persistent difficulties with global supply chain operations result in the fact that many factories are still not working at full capacity. Export-related industries are particularly affected and, over the longer term, are required to assess their overall supply chain strategies (Lin and Lanng 2020). Especially companies in developed countries are likely to develop and establish business strategies, such as a greater vertical integration, aiming to lower their dependencies on imports and suppliers from abroad, including those located in developing countries. Consequently, manufacturers in these countries might lose a sizeable share in the global value chain which bears the risk of premature deindustrialisation (UNIDO 2020a).

Further long-term impacts might include a delay in larger investments, a greater vertical integration (Rutgers 2020), and a shift of the focus from efficiency towards long-term value. Since economic uncertainty currently dominates investment decisions, as the volatility of stock markets shows, especially investment in innovation activities and the energy sector seem to be reduced or postponed. Further, the drop of fossil-fuel prices, like the sharp decline of the oil price in April, might lead to fewer investments in low-carbon and energy efficiency technologies (Dechezlepretre et al. 2020).

If industrial companies will be able to return to 'business as usual' or have to introduce some structural changes in their business models, highly depends on the development of the pandemic and related changes in consumer behaviour (Buchwaldt et al. 2020) and the duration of the related containment measures (UNIDO 2020b). However, in the middle- to long-run it is expected that these developments will likely result in a decrease of economic growth compared to pre-crisis levels (Buchwaldt et al. 2020) and as a consequence, emission levels will drop. Hence, baselines for the industry sector would need to be adjusted to the lower emission levels in an ex-post assessment.

3.2.3. Tourism (including aviation)

Especially small, non-G20 countries that rely heavily on revenues from travel services will be impacted by a decline in tourism (MacDonald et al. 2020). As long as international travel remains partially restricted, the baseline for the tourism sector would need to decrease in an ex-post adjustment. The duration of this effect depends on how fast the 'activity level' of tourism recovers. The increasing tourism activities in Europe during the summer months have shown that tourism might recover relatively quickly once a robust vaccine is available. A permanently reduced flight supply could result in higher prices and lower demand and might result in a permanently reduced baseline. Therefore, the development of the tourism 'activity level' would need to be closely monitored when updating the baseline.

At the global level, ICAO agreed to adjust the emission baseline for the Carbon Offsetting and Reduction Scheme in International Aviation (CORSIA) in response to the reduced numbers of flights due to the COVID-19 pandemic. Initially, the global market-based mechanism aimed at reducing CO₂ emissions stemming from international aviation by offsetting emissions above a baseline calculated as the average between airlines' 2019 and 2020 emissions. However, in June 2020 ICAO's Council decided to use the value of 2019 emissions for 2020 emissions to calculate the baseline, resulting in an increase by around 30% (Gordon-Harper 2020).

3.2.4. Transport (excluding aviation)

Surface transport emissions accounted for a daily emission reduction of 36% in April (Le Quéré et al. 2020a). The reduction of these emissions is closely linked to the reduction of overall road transportation, which declined by 50-75% (IEA 2020a). During the first COVID-19 induced lockdown, road transport activities in some large cities decreased accordingly by 50-75% (IEA, 2020d). Private car use has also decreased by 40% globally amid the COVID-19 lockdown (IEA 2020a). However, it needs to be emphasised that the extent to which road transport is reduced during a lockdown is dependent on the type of occupation the majority of a country's workforce is engaged in. In developing countries, usually, a major part of the population is working in the informal sector or doing physical labour in which cases home office is not an option and therefore it is also rather unlikely that road transport activities are reduced in the long run.

The road transport sector thus shows a medium- to long term diverging trend compared to other sectors. The longer the pandemic persists, the more people avoid public transportation as the risk of infection is relatively high in full buses or subways (Honey-Rosés et al. 2020; Surabi 2020). It should also be noted that the capacity of public transportation has been reduced in some developing countries to comply with social distancing rules, for example in cities like Addis Ababa, Lagos and Johannesburg (Bird et al. 2020). Therefore, a medium- to long-term effect of the pandemic is the increased use of private modes of transportation. This can imply a shift to micro-mobility transportation such as e-

scooters and (e-)bikes. But it can also mean that people increase car use, provided they actually have access to private cars which is not the case in many developing countries (Bird et al. 2020). Such an increase in private motorised transport in the medium-term would also result in higher GHG emissions in the transport sector. Consequently, this might also result in higher baselines.

4. The effect of the COVID-19 pandemic and climate-friendly recovery policies on carbon crediting

As shown above, the impact of the COVID-19 pandemic on the NDCs' stringency depends on the type of targets it comprises. In the case of an NDC with absolute targets based on historic emissions, it will be easier to meet the targets as when the GHG emissions were reduced by lower economic activities. NDCs with intensity-based targets, however, might see their target(s) becoming more stringent as a reduction of GDP usually entails increasing relative CO₂ emission as during the financial crisis.

At the sectoral level, the identified COVID-19 effects have an impact on the ability of policies to generate credits due to the changes of the baseline discussed in the preceding section. We first outline the potential effects of the sector-specific changes in GHG emissions on the volume of credits to be generated by certain policies are outlined, before then considering the impact of adopted recovery policies.

Policy instruments, such as feed-in tariffs to promote the use of renewable energies or the introduction of subsidies for efficiency improvements, will generate less credits once the baseline emissions intensity of the electricity sector declines due to the replacement of fossil power plants that have high generation costs, with energy and cost-efficient options. As the developments over the last months have shown, such effects can be short lived (Le Quéré 2020b). If the baseline increases in the long term, as a consequence of less available capital for renewable energy investments, the volume of credits would increase.

Other sectors have also been heavily impacted by the COVID-19 pandemic. Against the background of temporary travel restrictions and difficult travel conditions, the tourism sector has seen the sharpest decline in emissions in 2020. For this reason, crediting policies need to be well focused. Crediting activities that focus on energy efficiency improvements in barely operating hotels or other types of accommodations and the use of low emissions vehicles at closed tourist sites will not generate any credits.

The risk of infection is high in public transportation. Therefore, a shift from public to private modes of transportation is taking place (Bird et al. 2020). Whether such a shift occurs has also been dependent on the car ownership rate and the usual usage of public transportation. In case more private modes of transportation are used, transport sector emissions will rise. Through the combined effect of a shift in baselines as well as declining user rates, mitigation policies focusing on increasing public transportation through for example the introduction of a bus rapid transport system would generate less credits. On the other side, policies that promote the purchase of low emissions vehicles will generate more credits. The same applies to policies that promote non-motorised types of transportation through the expansion of bike lanes, as these would generate more credits after the reassessment of the baseline.

Most importantly, the mitigation policies developed for crediting under Article 6 should be in line with COVID-19 recovery strategies. So far, only few developing countries have implemented recovery

measures, and even fewer have implemented *climate-friendly* recovery measures (Table 2 in the Appendix provides an overview of the identified recovery policies in developing countries).

Ideally, mitigation activities and policies aiming to generate credits under Article 6 of the Paris Agreement should focus on those sectors that see an increase of baselines due to COVID-19. As shown above, this is most likely in the transport sector. Policies which would generate more credits due to increasing baselines include those that lead to zero emissions in private transportation such as the promotion of e-mobility vehicles. China's recovery strategy promotes, among other things, smart grid solutions and the expansion of electric vehicle charging infrastructure. This is a good example a policy that could create more credits due to the COVID-19 pandemic.

Policies promoting renewable electricity generation and efficiency improvement of electric devices, such as Colombia's recovery strategy, will face a less attractive baseline than pre-COVID-19, at least in the short run. Despite this, renewable energy support policies are urgently required, especially in countries that pursue plans to expand coal power fuelled by recovery funding such as in Indonesia and Vietnam. Considering the natural potential of Indonesia, a policy could finance large solar power plants and green hydrogen production infrastructure instead of coal power plants. The generated green hydrogen could then be used for electricity generation (even baseload to overcome the intermittency problem of solar power), and potentially even for export. Such large infrastructure investments will require a substantial work force, and are therefore well-suited for Article 6-supported recovery programmes, while they may make a difference with regard to technology lock-in and transformation of energy systems.

However, an additional effect of the implementation of recovery policies is a squeeze in available funding. As a consequence of the COVID-19 pandemic, developing countries already spend less on climate actions (Vieira 2020). The Indonesian government notes for example, that the country can only focus on recovery policies from 2021 onwards as all available funding would currently be required for emergency spending on the health sector, social safety net and economic stability (Medrilzam 2020). Indonesia aims to adopt a green stimulus package by 2022. This also shows that currently insufficient resources are available for investments in climate-friendly recovery policies. This, in turn, poses an opportunity for leveraged finance from Article 6 market mechanisms.

5. Conclusion

This paper's analysis has shown that COVID-19 and its corresponding policies have different direct and indirect impacts on developing countries' emissions and crediting policies.

First, the analysis of the sector-specific impacts showed that short-term political reactions to the COVID-19 pandemic have led to a **drastic and sudden reduction of GHG emission**. Some sectors, such as tourism and industry, have been particularly affected by (inter-)national travel restrictions and factory shutdowns.

Second, while developing countries are still focusing on emergency measures, **substantial recovery measures remain limited to G20 countries**. Only few recovery measures exist in developing countries to date, and their overall financial resources remain rather limited. Those recovery measures that have been identified, generally provide **unconditional loans or financial relief without demanding substantial shifts toward green policies**. Moreover, most of the recovery measures provide **economy-wide support**, while sector-specific attention is only given in a few cases.

Third, the effects of the COVID-19 pandemic on countries' emissions impact their climate goals, more specifically their NDC stringency. Ideally, **NDC updates should consider shifts in baselines due to the COVID-19 pandemic**. Furthermore, the pandemic's impact on GHG emissions and consequently the need to adjust baselines, will also affect **countries' ability to credit policies**, as the amount of internationally transferred mitigation outcomes is lowered or increased in specific sub-sectors. In the energy sector, baselines are likely to decrease while in the transport sector, they could increase. In the latter, however, policies trying to achieve a shift of the modal split toward public transport may suffer from the trend towards private transport triggered by the pandemic. Policies addressing the tourism sector need to consider the possible continuation of low capacity utilisation of tourist infrastructure. These (sub)-sector-specific effects should be taken into account in international carbon market cooperation to prevent the production of hot air.

Actors developing Article 6 pilot activities should consider these effects in the selection of their pilots. For example, the Swiss KliK Foundation should integrate post-COVID-19 recovery considerations in the evaluation of submissions.

6. References

- Baruah, Pranab; Mraz, Marian; Aouane, Fenella; Michaelowa, Axel; Poralla, Matthias; Kessler, Juliana; Butzengeiger-Geyer, Sonja; Brescia, Dario (2020): Designing Policy Approaches under Article 6 Effects of the COVID-19 Pandemic on the Climate Policy Landscape in Selected Countries, GGGI paper forthcoming, <https://gggi.org/reports/>
- Bird, Julia; Kriticos, Sebastian; Tsivanidis, Nick (2020): Impacts of COVID-19 on public transportation, <https://www.theigc.org/blog/impact-of-covid-19-on-public-transport/> (accessed October 25, 2020)
- Buchwaldt, Andreas; Engler, Glenn; Kobayashi, Nobuko; Robb, Mathew; Schulz, Otto; Hearn, Andrew (2020): Beyond COVID-19. Reflections on the long-term impact of a new type of crisis, https://www.ey.com/en_gl/strategy/beyond-covid-19-what-will-be-the-crisis-s-lasting-impact (accessed September 09, 2020)
- Carbon Brief (2020): Coronavirus: Tracking how the world's 'green recovery' plans aim to cut emissions, <https://www.carbonbrief.org/coronavirus-tracking-how-the-worlds-green-recovery-plans-aim-to-cut-emissions> (accessed October 12, 2020)
- Castro, Paula; Hayashi, Daisuke; Harthan, Ralph; Cames, Martin; Michaelowa, Axel (2012): Setting baselines for the new market mechanism: Examples from the power, cement and building sectors, University of Zurich, Zurich.
- Climate Action Tracker (2020): A government roadmap for addressing the climate and post COVID-19 economic crises, <https://climateactiontracker.org/publications/addressing-the-climate-and-post-covid-19-economic-crises/> (accessed August 20, 2020)
- Dechezlepretre, Antoine; Kozluk, Tomasz; Elgouacem, Assia; Kruse, Tobias (2020): COVID-19 and the low-carbon transition: Impacts and possible policy responses, <http://www.oecd.org/coronavirus/policy-responses/covid-19-and-the-low-carbon-transition-impacts-and-possible-policy-responses-749738fc/#contactinfo-d7e3405> (accessed October 25, 2020)
- Doyle, Alister (2020): China among nations likely to miss 2020 deadline for climate plan – UN's Espinosa, <https://www.climatechangenews.com/2020/09/02/china-among-nations-likely-miss-2020-deadline-climate-plans-uns-espinosa/> (accessed September 4, 2020)
- Energy Policy Tracker (2020): Track public money for energy in recovery packages, <https://www.energypolicytracker.org/> (accessed October 12, 2020)
- Egypt Independent (2020): Minister details plan to replace Egypt's obsolete cars with natural gas vehicles, <https://egyptindependent.com/minster-details-plan-to-replace-egypts-obsolete-cars-with-natural-gas-vehicles/> (accessed September 29, 2020)
- Ernst & Young (EY) (2020): EY tax COVID-19 response tracker, https://www.ey.com/en_gl/tax/how-covid-19-is-causing-governments-to-adopt-economic-stimulus-- (accessed August 6, 2020)
- ETH Zurich, University of Basel (2020): MOBIS-COVID19/27. Results as of 02/11/2020 (Second Wave), <https://ivtmobis.ethz.ch/mobis/covid19/reports/latest> (accessed November 15, 2020)
- Fakhruddin, Bapon; Blanchard, Kevin; Ragupathy, Durga (2020): Are we there yet? The transition from response to recovery for the COVID-19 pandemic, in: Progress in Disaster Science 7, 100102.
- Fischedick, Manfred; Schneidewind, Uwe (2020): The Corona crisis and climate protection – keeping long-term goals in mind: cleverly directing economic aid and exploiting synergy potentials for urgently needed investments, Wuppertal Institute, Wuppertal
- Forster, Piers; Forster, Harriet; Evans, Mat. et al. (2020): Current and future global climate impacts resulting from COVID-19, in: Nature Climate Change, 10, p. 913–919

Fulwood, Mike (2020): Impacts of COVID-19 on global gas markets: short-term impact, presentation held at The Oxford Institute for Energy Studies webinar, May 2020, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/05/The-Impact-of-COVID-19-on-Gas-Markets.pdf> (accessed September 5, 2020)

Gordon-Harper, Gabriel (2020): CORSIA baseline adjustment in response to COVID-19: a blessing or a curse?, <http://sdg.iisd.org/commentary/policy-briefs/corsia-baseline-adjustment-in-response-to-covid-19-a-blessing-or-a-curse/> (accessed September 9, 2020)

Government of Colombia (2020): Compromiso por Colombia, <https://id.presidencia.gov.co/Paginas/prensa/2020/COMPROMISO-POR-COLOMBIA-Transicion-energetica-y-crecimiento-limpio-en-el-foco-del-Gobierno-para-proximos-dos-anos-200807.aspx> (accessed September 29, 2020)

Hale, Thomas; Webster, Sam; Petherick, Anna; Phillips, Toby; Kira, Beatriz (2020): Oxford COVID-19 government response tracker, <https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker#data> (accessed August 6, 2020)

Harsono, Norman (2020): ADB pledges to double funds for Indonesia, pushes for green recovery, <https://www.thejakartapost.com/news/2020/08/21/adb-pledges-to-double-funds-for-indonesia-pushes-for-green-recovery.html> (accessed October 25, 2020)

Hepburn, Cameron; O'Callaghan, Brian; Stern, Nicholas; Stiglitz, Joseph; Zenghelis, Dimitri (2020): Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?, in: Oxford Review of Economic Policy, 36, p. 3-48

Honey-Rosés, Jordi; Anguelovski, Isabelle; Bohigas, Josep; Chrieh, Vincent; Daher, Carlyn; Knoijnendijk, Cecil; Litt, Jill; Mawani, Vrushti; McCall, Michael; Orellana, Arturo; Oscilowicz, Emilia; Sánchez, Ulises; Senbel, Maged; Tan, Yueqi; Villagomez, Erick; Zapata, Oscar; Nieuwenhuijsen, Mark (2020): The Impact of COVID-19 on public space: a review of the emerging questions, <https://osf.io/rf7xa/> (accessed June 25, 2020)

International Civil Aviation Organization (ICAO) (2020): Operational impact on air transport, <https://data.icao.int/coVID-19/operational.htm> (accessed November 15, 2020)

International Energy Agency (IEA) (2020a): Global Energy Review 2020, <https://www.iea.org/reports/global-energy-review-2020> (accessed August 6, 2020)

International Energy Agency (IEA) (2020b): Renewable energy market update: outlook for 2020 and 2021, IEA, Paris

International Energy Agency (IEA) (2020c): Sustainable recovery: world energy outlook special report, IEA, Paris

International Energy Agency (IEA) (2020d): The impact of the Covid-19 crisis on clean energy progress, IEA, Paris <https://www.iea.org/articles/the-impact-of-the-covid-19-crisis-on-clean-energy-progress> (accessed October 25, 2020)

International Federation of Red Cross and Red Crescent Societies (IFRC) (2020): disaster risk management policy - from prevention to response and recovery, <https://reliefweb.int/report/world/disaster-risk-management-policy-prevention-response-and-recovery> (accessed August 6, 2020)

International Labour Organization (ILO) (2020): A policy framework for tackling the economic and social impact of the COVID-19 crisis, <https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/lang--en/index.htm> (accessed August 6, 2020)

International Monetary Fund (IMF) (2020a): Policy responses to COVID-19, <https://www.imf.org/en/Topics/imf-and-COVID19/Policy-Responses-to-COVID-19> (accessed August 6, 2020)

International Monetary Fund (IMF) (2020b): World Economic Outlook Update, June 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020> (accessed August 6, 2020)

Jones, Dave; Graham, Euan; Tunbridge, Pete (2020): Wind and solar now generate one-tenth of global electricity: Global half-year electricity analysis, <https://ember-climate.org/project/global-electricity-h12020/> (accessed September 4, 2020)

Kollmuss, Anja; Schneider, Lambert; Zhezherin, Vladislav (2015): Has joint implementation reduced ghg emissions? Lessons learned for the design of carbon market mechanisms, SEI Working Paper No. 2015-07, Stockholm: Stockholm Environment Institute

KPMG (2020): Government stimulus tracker, <https://home.kpmg/xx/en/home/insights/2020/04/government-response-global-landscape.html> (accessed August 6, 2020)

Le Quéré, Corinne; Jackson, Robert B.; Jones, Matthew W.; Smith, Adam J.P.; Abernethy, Sam; Andrew, Robbie M.; De-Gol, Anthony J.; Willis, David R.; Shan, Yuli; Canadell, Josep G.; Friedlingstein, P.; Creutzig, F.; Peters, Glen P (2020a): Temporary reduction in daily global CO₂ emissions during the COVID-19 forced confinement, in: Nature Climate Change, 10, p. 647-653

Le Quéré, Corinne; Jackson, Robert B.; Jones, Matthew W.; Smith, Adam J.P.; Abernethy, Sam; Andrew, Robbie M.; De-Gol, Anthony J.; Shan, Yuli; Canadell, Josep; Friedlingstein, Pierre; Creutzig, Felix, & Peters, Glen (2020b). Supplementary data to: Le Quéré et al (2020b), Temporary reduction in daily global CO₂ emissions during the COVID-19 forced confinement (Version 1.0). Global Carbon Project, <https://www.icos-cp.eu/gcp-COVID19> (accessed August 6, 2020)

Lin, Jesse; Lanng, Christian (2020): Here's how global supply chains will change after COVID-19, , <https://www.weforum.org/agenda/2020/05/this-is-what-global-supply-chains-will-look-like-after-COVID-19/> (accessed June 30, 2020)

Liu, Z., Ciais, P., Deng, Z. (2020) : Near-real-time monitoring of global CO₂ emissions reveals the effects of the COVID-19 pandemic. Nature Communications, 11, 5172

MacDonald, Margaux; Piazza, Roberto; Sher, Galen (2020): A simple guide to estimating the impact of COVID-19 on travel and hospitality activity, IMF, Washington

Medrilzam, Medrilzam (2020): Indonesia's recovery strategy, presentation held at the Climate Change Expert Group (CCXG) Global Forum on the Environment and Climate Change, Virtual Forum, September 16, 2020

Michaelowa, Axel; Hermwille, Lukas; Obergassel, Wolfgang; Butzengeiger, Sonja (2019): Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement, in: Climate Policy, 19, p. 1211-1224

Newland Chase (2020): COVID-19: Latest Travel and Immigration Updates, updated daily, <https://newlandchase.com/covid-19-latest-travel-and-immigration-disruption/> (accessed November 15, 2020)

Organisation for Economic Co-operation and Development (OECD) (2020): Country policy tracker, <https://www.oecd.org/coronavirus/country-policy-tracker/> (accessed August 6, 2020)

Our World in Data (2020): Total confirmed COVID-19 deaths, <https://ourworldindata.org/grapher/total-deaths-COVID-19> (accessed October 26, 2020)

Rutgers, Vincent (2020): COVID-19's impact on industrial products & construction firms, <https://www2.deloitte.com/global/en/pages/about-deloitte/articles/covid-19/covid-19-s-impact-on-industrial-products---construction-firms.html#> (accessed September 09, 2020)

Sierra Club (2020): Millions of good jobs: a plan for economic renewal, <https://www.sierraclub.org/trade/millions-good-jobs-plan-for-economic-renewal> (accessed August 6, 2020)

Stiglitz, Joseph (2020): Four priorities for pandemic relief efforts, Roosevelt Institute Paper.

Surabi, Menon (2020): COVID-19 and climate action: understanding key trends, Climate Works Foundation, San Francisco

United Nations Industrial Development Organization (UNIDO) (2020a): Managing COVID-19: Why poorer countries may drop out of industrialization, <https://www.unido.org/stories/managing-covid-19-why-poorer-countries-may-drop-out-industrialization> (accessed October 25, 2020)

United Nations Industrial Development Organization (UNIDO) (2020b): Coronavirus: the economic impact – 21 October 2020, <https://www.unido.org/stories/coronavirus-economic-impact-21-october-2020> (accessed October 30, 2020)

United Nations World Tourism Organization (UNWTO) (2020): International travel plunges 70% in the first eight months of 2020, <https://www.e-unwto.org/doi/epdf/10.18111/wtobarometereng.2020.18.1.6> (accessed November 6, 2020)

Vieira, Pablo (2020): COVID-19 recovery and climate change, <https://ndcpartnership.org/news/covid-19-recovery-and-climate-change> (accessed on November 24, 2020)

World Bank (2020a): Global Economic Prospects, June 2020, World Bank, Washington, DC.

World Bank (2020b): World Bank Country and Lending Groups, <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (accessed October 12, 2020)

World Trade Organization (WTO) (2020): Trade Set to Plunge as COVID-19 Pandemic Upends Global Economy, https://www.wto.org/english/news_e/pres20_e/pr855_e.htm (accessed August 6, 2020)

7. Appendix

Table 2: COVID-19 recovery measures in developing countries

Country	Recovery measures	Sectoral scope
Angola	<ul style="list-style-type: none"> The central bank has expanded its credit-stimulus program allowing banks to deduct from their reserve requirement obligations the amount of credit extended to selected sectors targeted by an ongoing import substitution/export promotion program. 	<ul style="list-style-type: none"> Economy-wide
Barbados	<ul style="list-style-type: none"> Key initiatives include a 12-month jobs program and a tourism-sector stimulus and transformation package (available for up to two years). 	<ul style="list-style-type: none"> Economy-wide Tourism
Bangladesh	<ul style="list-style-type: none"> Government announces details of its USD 595 million stimulus package for export-oriented industries. This includes assistance towards salaries and funding of 2 year loans to factory owners at 2% interest. Stimulus packages of USD 8 billion planned to implement in immediate, short and long phases through four programs (increasing public expenditure, formulating a stimulus package, widening social safety net coverage and increasing monetary supply). 	<ul style="list-style-type: none"> Economy-wide Industry
Botswana	<ul style="list-style-type: none"> The parliament has approved the mid-term review of NDP 11 including a USD 1.5 billion stimulus to support the recovery and facilitate structural transformation. 	<ul style="list-style-type: none"> Economy-wide
Brazil	<ul style="list-style-type: none"> On August 17, the Ministry of Economy released the National Investment Plan (PNI), which foresees actions, until 2022, for the resumption of the business environment and the recovery of COVID-19's post-pandemic economy. The Governance and Transparency pillar focuses on improving governance at the federal level and establishes a line of work to improve coordination and implementation of policies and guidelines related to foreign direct investments in the country and investments Brazilians abroad. The Investment Facilitation pillar provides for greater alignment between federal government projects to make the investment environment more attractive, with greater transparency and predictability. The Regulatory Improvement pillar seeks to guide efforts towards the construction of the Regulatory Agenda for Improvement of the Investment Environment. 	<ul style="list-style-type: none"> Economy-wide
Brunei	<ul style="list-style-type: none"> The value of Brunei's Economic Stimulus Package totals USD 330 million (or 3.2 percent of GDP), e.g. by extending the deferment on principal payments of financing or loan to all sectors and providing for the restructuring or deferment on principal repayment of personal loans and hire purchase such as car financing, for a period not exceeding 10 years. 	<ul style="list-style-type: none"> Economy-wide

Country	Recovery measures	Sectoral scope
Chile	<ul style="list-style-type: none"> Chile has released a coronavirus recovery plan, titled “step by step, Chile recovers”, which it says places climate action at its core. The government states its public investment programme, which comprises everything from major infrastructure projects to home insulation, will be given an additional USD 4.5 billion on top of its regular budget over the next two years. It also says 30% of these projects will “contribute to accelerating our transition towards sustainable development and mitigating and adapting our country to climate change”. 	<ul style="list-style-type: none"> Economy-wide
China	<ul style="list-style-type: none"> The government has pledged an extra USD 500 billion in stimulus to help the coronavirus recovery, with a particular focus on supporting “new infrastructure”, such as 5G and ultra-high voltage electricity transmission, such as high-speed rail, smart grid and electric vehicle chargers but much of the stimulus funding may still be funnelled into carbon-intensive infrastructure spending. 	<ul style="list-style-type: none"> Electricity Transport
Colombia	<ul style="list-style-type: none"> The Colombian government has identified “clean and sustainable growth” as one of the pillars of its recovery plan, described as the “new commitment to the future of Colombia”. In a bid to secure Colombia as a “regional leader in the energy transition”, the government says it will spend more than USD 4.1 billion on 27 renewable energy and transmission projects, hoping to create about 55,000 jobs. In order to activate the economy, the government has authorized the continuity of the construction and manufacturing sectors. The Government has also opened a new credit line and introduced various taxation adjustments for the tourism and aviation sector. 	<ul style="list-style-type: none"> Electricity Tourism
Comoros	<ul style="list-style-type: none"> The government announced a program to support agriculture and tourism with USD 25 million financing from the World Bank. 	<ul style="list-style-type: none"> Agriculture Tourism
Dominican Republic	<ul style="list-style-type: none"> Special regulatory treatment measures for the financial system (for instance, authorize financial institutions to freeze the ratings and provisions of the debtors at the level such where at the time of the approval of the Resolution); Interest rate measures (e.g. a decrease of 150 basis points in the interest rate of the permanent liquidity expansion facility from 6.00% to 4.50% annually); Liquidity provision measures to the financial system: the constitution of a Guarantee and Financing Fund to benefit micro and small businesses. This fund, which will have the technical support of multilateral organizations, will guarantee a portfolio of up to USD 2.1 billion made up of loans currently in force and new loans aimed at micro and small enterprises that belong to the commerce, construction, tourism, education, manufacturing, transportation, storage and agricultural sectors, among others. 	<ul style="list-style-type: none"> Economy-wide Tourism Transport Agriculture

Country	Recovery measures	Sectoral scope
Egypt	<ul style="list-style-type: none"> Government announced stimulus policies in the USD 6.13 billion package (1.8 percent of GDP), including a consumer spending initiative New lending initiative with soft loans at zero-to-low interest rates from banks is aimed at replacing old cars with natural gas-powered vehicles. The suspension of the agriculture holding tax is extended for more two years. 	<ul style="list-style-type: none"> Transport Tourism
Fiji	<ul style="list-style-type: none"> Agricultural Response Package includes the scaling up of the existing Home Gardening program and a new Farm Support Package which aims at boosting the production of short-term crops. The government also introduced several additional allocations amounting USD 24 million for the development of sugar sector. 	<ul style="list-style-type: none"> Agriculture
Grenada	<ul style="list-style-type: none"> The Cabinet appointed seven sub committees as part of a task force for rebuilding the economy post COVID-19 to identify short and medium-term priorities, implementation plans, resource requirements, risks, and mitigation measures. The sub committees will also collaborate with the Working Group for the National Sustainable Development Plan 2020-2035 to ensure alignment with national priorities. 	<ul style="list-style-type: none"> Economy-wide
Guyana	<ul style="list-style-type: none"> Ministries of Business and Agriculture began working to assist farmers affected by the pandemic with stimulus grants, and the Department of Tourism in the Ministry of Business has collaborated with the Guyana Tourism Authority, and other bureaus to establish the Tourism Recovery Action Committee (TRAC). The government facilitates a long-term strategic approach to COVID relief efforts. The assistance includes vouchers and packaged hampers for the coastland and the hinterland respectively. On September 10, the new government presented its USD 1.5 billion emergency budget to revitalize productive and infrastructure sectors. 	<ul style="list-style-type: none"> Tourism Agriculture
India	<ul style="list-style-type: none"> Despite plans for a USD 266 billion stimulus package, there has been little evidence of specifically “green” intentions from the Indian government in its post-coronavirus strategy. In fact, many of the emergency response measures announced so far actively support the nation’s highest polluting industries. Among these measures are providing USD 6.6 billion for coal infrastructure, promoting coal gasification with tax incentives and fast-tracking the approval process to clear areas of forest for industrial uses. The government’s decision to open up 41 coal mining blocks to private investors with the goal of creating jobs has drawn criticism. 	<ul style="list-style-type: none"> Electricity

Country	Recovery measures	Sectoral scope
	<ul style="list-style-type: none"> Additional money channelled through the Compensatory Afforestation Fund Management and Planning Authority (CAMPA) is intended to help provide jobs for tribal groups in plantation work, forest management and wildlife conservation. 	
Indonesia	<ul style="list-style-type: none"> The Indonesian government announced to provide additional spending for economy-wide recovery measures totalling over USD 21 billion. The government is considering to introduce incentives like electricity subsidies and fuel price reductions. The Ministry of Finance has installed support measures for the renewable energy sector such as tax exemptions for renewable energy companies, adjustment to procurement terms or subsidies for the utilisation of biofuels. Asian Development Bank (ADB) has pledged to double its loan commitments to Indonesia in order to support the country's economic recovery. ADB Country Director encourages the government to step up the investments in renewable energy as a key part of economic recovery plans. ADB is particularly supportive of geothermal power projects in the country, considering it an important sector for job creation and fostering green growth. 	<ul style="list-style-type: none"> Electricity
Jamaica	<ul style="list-style-type: none"> The government adopted a multi-billion stimulus package consisting of tax waivers, productivity incentives, reduction of interest rates and suspension of fiscal rules. The packages foresees investments in resilience, energy-efficient infrastructure and an extended use of technology to reduce vulnerability in the agricultural sector. 	<ul style="list-style-type: none"> Economy-wide
Kazakhstan	<ul style="list-style-type: none"> USD 4 billion is allocated to support employment under an "Employment Roadmap" program, including some large-scale projects to modernize the transportation infrastructure. Selected enterprises and individual entrepreneurs are also eligible for new tax incentives. Further measures recently announced to restore economic growth include: a subsidized mortgage program for households with a segment targeting youth specifically, tax incentives to agriculture and hard-hit sectors (civil aviation, tourism), credit support to SMEs and manufacturing enterprises (the latter via a newly created industry development fund), and infrastructure development. 	<ul style="list-style-type: none"> Transport Agriculture Tourism Industry
Kenya	<ul style="list-style-type: none"> Kenya has predominantly focused on economic stimulus measures thus far, cutting the MPC policy rate and reducing cash reserve ratios. There are also industry specific packages (such as the USD 5 million available to the tourism industry). 	<ul style="list-style-type: none"> Economy-wide Tourism
Malaysia	<ul style="list-style-type: none"> Malaysian Government has unveiled National Economic Recovery Plan (USD 8.4 billion) with its main goals of 	<ul style="list-style-type: none"> Economy-wide

Country	Recovery measures	Sectoral scope
	empowering people, propelling business and stimulating the economy, including measures such as reskilling and upskilling programmes to enhance employability; subsidies for the public transport systems, enhancement of internet connectivity and digitalization as well as tourism financing.	<ul style="list-style-type: none"> • Tourism
Nepal	<ul style="list-style-type: none"> • Finance Minister Khatriwada announced additional measures in the areas of healthcare, business-support (a lending program for cottage, small and medium-sized enterprises and those in the tourism sector), and job-creation (labour-intensive in the construction sector, and training for work in manufacturing and services sectors). 	<ul style="list-style-type: none"> • Tourism • Industry
Nigeria	<ul style="list-style-type: none"> • Nigeria has announced a post-coronavirus economic plan titled “bouncing back”, which includes a focus on expanding the nation’s solar infrastructure. The recovery plan includes a focus on promoting "sustainable research and development in renewable and alternative energy sources", particularly solar. • It also contains plans for a gas expansion programme, which the government says “will accelerate the transition of Nigeria to a post-oil era” and “promote the domestic use of cleaner fuels”. • They have also unveiled a USD 6 billion stimulus package which focuses on job-intensive projects including in agricultural, road, and housing sectors 	<ul style="list-style-type: none"> • Energy • Agriculture
Peru	<ul style="list-style-type: none"> • The government has introduced a revised depreciation regime benefitting the purchase of hybrid and electric ground transportation vehicles (50% depreciation vs. 33% depreciation for EURO IV engines) 	<ul style="list-style-type: none"> • Transport
Senegal	<ul style="list-style-type: none"> • Senegal created a COVID-19 growth and economic watch committee. And finally, the development of a contingency plan following the evolution of the pandemic for an amount of USD 115 million. Creation of a fund with an envelope of USD 2.5 million. Establishment of an envelope of USD 180 million specifically dedicated to the direct support of the sectors of the economy affected the most by the crisis, in particular transport, hotel industry but also agriculture; Establishment of a financing mechanism up to USD 360 million, accessible to affected companies, according to a simplified procedure. 	<ul style="list-style-type: none"> • Economy-wide • Transport • Tourism
Solomon Islands	<ul style="list-style-type: none"> • The government has adopted a COVID-19 economic stimulus package of USD 39 million (about 2.6 percent of GDP), to be financed by both government and donors. This includes ongoing payroll support for non-essential public servants; employment support for youth and women; subsidies for copra and cocoa; capital grants to businesses to support investment in productive and 	<ul style="list-style-type: none"> • Economy-wide • Agriculture

Country	Recovery measures	Sectoral scope
	resource sectors; tax and utility relief for affected businesses in specific sectors; equity injection to government owned companies; and advancing planned infrastructure investment .	
St. Lucia	<ul style="list-style-type: none"> Government announced an Economic Recovery and Resilience Plan (11.5 percent of GDP), including an electricity assistance program, an expansion of the public assistance and provision of grants and loans to enterprises. 	<ul style="list-style-type: none"> Electricity
St. Vincent & The Grenadines	<ul style="list-style-type: none"> A USD 15 million job-creating stimulus package is proposed. 	<ul style="list-style-type: none"> Economy-wide
Sudan	<ul style="list-style-type: none"> Key policy measures include removal of subsidies on gasoline and diesel, and exchange rate reforms, as well as increased domestic revenue mobilization. 	<ul style="list-style-type: none"> Energy
Tunisia	<ul style="list-style-type: none"> The tourism sector (hotels, travel agencies, restaurants, craftsmen, transport, culture) is particularly targeted by this MF measure. 	<ul style="list-style-type: none"> Tourism
Vietnam	<ul style="list-style-type: none"> Newly approved measures include cutting registration tax by 50 percent and deferring excise tax on domestically produced cars, lower business registration fee effective from February 25 (one-year exemption of business registration tax for newly established household business; first 3-year exemption of business registration tax for SMEs. Recently the SBV also asked Credit Institutions to not only channel credit to 5 priority economic sectors, but also to accelerate consumer loans to meet legitimate demand of individuals and households. The Ministry of Finance announced a reduction of the environmental protection tax for aircraft fuels by 30% until the end of this year. The government also introduced recovery plans for the electricity sector including mobilising public and private finance for thermal power plants, gas power plants, and electricity transmission and developing new feed-in tariffs for solar and wind. 	<ul style="list-style-type: none"> Economy-wide Transport Electricity

Source: Authors based on IMF (2020a), Hale et al. (2020), EY (2020), OECD (2020), KPMG (2020) and Energy Policy Tracker (2020).

Note: Climate friendly recovery measures are marked green.